CLAIMS

1. A zoom lens comprising at least three lens groups that are arranged in order of a first lens group that has positive refractive power, and a second lens group that has negative refractive power, as seen from the side having the longer conjugate distance;

wherein the first lens of the lenses of the second lens group as seen from the side having the longer conjugate distance has positive refractive power.

2. The zoom lens according to claim 1,

wherein the refractive power of the lenses of the second lens group is positive, negative, negative, positive, negative, as seen from the side having the longer conjugate distance.

3. The zoom lens according to claim 1,

wherein the refractive power of the lenses of the second lens group is positive, negative, negative, negative, positive, negative, as seen from the side having the longer conjugate distance.

4. The zoom lens according to claim 1, wherein the following relationship is satisfied:

$-0.6 < f2g/f2top < -0.15$

where f2top is the focal length of a first lens, as seen from the side having the longer conjugate distance, of the lenses of the second lens group, and where f2g is the focal length of the second lens group.

5. The zoom lens according to claim 1, wherein the following relationship is satisfied:

$0.25 < frear/f2top < 0.95$

where f2top is the focal length of a first lens, as seen from the side having the longer conjugate distance, of the lenses of the second lens group, and where frear is the focal length of the lens group on the side having the shorter conjugate distance, with respect to an aperture stop.

6. The zoom lens according to claim 1,

wherein the front lens, as seen from the side having the longer

conjugate distance, is a negative lens, and

wherein the following relationships are satisfied:

$-0.018 < (1/f1/abe1) / (1/frear) < 0$

$1.7 < nd11 < 1.79$

where f1 is the focal length of the negative lens, where abe1 is the Abbe number and where nd11 is the refractive index at the d line, and where frear is the focal length of the lens group on the side having the shorter conjugate distance, with respect to an aperture stop.

7. The zoom lens according to claim 1,

wherein four lenses, as seen from the side having the shorter conjugate distance, comprises:

from the side having the longer conjugate distance, a negative meniscus lens whose convex surface faces the side having the longer conjugate distance, a positive lens, a negative meniscus lens whose convex surface faces the side having the shorter conjugate distance and a positive lens,

wherein the following relationships are satisfied:

$nd4 > 1.75$

$\nu d4 > 40$

$1 < f4r/bfw < 4$

where nd4 is the refractive index at the d line of the negative meniscus lens that is on the side having the longer conjugate distance, where $\nu d4$ is the Abbe number, where f4r is the focal length of the four lenses and where bfw is the air equivalent back focus that does not include a prism and a cover glass when at the wide angle end.

8. The zoom lens according to claim 1,

wherein the first lens group that has positive refractive power, the second lens group that has a negative refractive index and the third lens group that has a positive refractive index, are arranged in that order from the side having the longer conjugate distance;

wherein when changing magnification from the wide angle end to the telephoto end, the first lens group, the second lens group and the third lens group move along the optical axis;

wherein the first lens group moves monotonically toward the side having the longer conjugate distance, the second lens group moves

monotonically toward the side having the shorter conjugate distance and the third lens group moves monotonically toward the side having the longer conjugate distance; and

wherein the following relationship is satisfied:

$1.6 < bfw/fw < 2.4$

where bfw is the air equivalent back focus of the zoom lens at the wide angle end when at infinity and where fw is the focal length of the zoom lens at the wide angle end.

9. The zoom lens according to claim 8,

wherein the following relationships are satisfied:

$0.05 < fw/f1g < 0.2$

$-0.9 < fw/f2g < -0.6$

$0.5 < fw/f3g < 0.7$

where f1g is the focal length of the first lens group, where f2g is the focal length of the second lens group, where f3g is the focal length of the third lens group, and where fw is the focal length of the zoom lens at the wide angle end.

10. The zoom lens according to claim 1,

wherein the first lens group that has positive refractive power, the second lens group that has a negative refractive index and the third lens group that has a positive refractive index, are arranged in that order from the side having the longer conjugate distance;

wherein when changing magnification from the wide angle end to the telephoto end, the first lens group, the second lens group and the third lens group move along the optical axis;

wherein the first lens group moves monotonically toward the side having the longer conjugate distance, the second lens group moves monotonically toward the side having the shorter conjugate distance and the third lens group moves monotonically toward the side having the longer conjugate distance; and

wherein the following relationship is satisfied:

$1 < bfw/fw < 1.8$

where bfw is the air equivalent back focus of the zoom lens at the wide angle end when at infinity and where fw is the focal length of the zoom lens at the wide angle end.

11. The zoom lens according to claim 10,

wherein the following relationships are satisfied:

$0.3 < fw/f1g < 0.4$

$-1.6 < fw/f2g < -1.3$

$0.7 < fw/f3g < 0.9$

where f1g is the focal length of the first lens group, where f2g is the focal length of the second lens group, where f3g is the focal length of the third lens group, and where fw is the focal length of the zoom lens at the wide angle end.

12. A zoom lens comprising a first lens group that has positive refractive power, a second lens group that has a negative refractive index and a third lens group that has a positive refractive index, arranged in that order from the side having the longer conjugate distance;

wherein when changing magnification from the wide angle end to the telephoto end, the first lens group, the second lens group and the third lens group move along the optical axis;

wherein the first lens group moves monotonically toward the side having the longer conjugate distance, the second lens group moves monotonically toward the side having the shorter conjugate distance and the third lens group moves monotonically toward the side having the longer conjugate distance; and

wherein the following relationship is satisfied:

$0.5 < bfw/fw < 1.3$

where bfw is the air equivalent back focus of the zoom lens at the wide angle end when at infinity and where fw is the focal length of the zoom lens at the wide angle end.

13. The zoom lens according to claim 12

wherein the following relationships are satisfied:

$0.45 < fw/f1g < 0.6$

$-2.0 < fw/f2g < -1.6$

$0.9 < fw/f3g < 1.3$

where f1g is the focal length of the first lens group, where f2g is the focal length of the second lens group, where f3g is the focal length of the third lens group, and where fw is the focal length of the zoom lens at

the wide angle end.

14. The zoom lens according to claim 1,

wherein the Abbe number of all lenses having positive refractive power that are arranged on the side having the shorter conjugate distance with respect to an aperture stop is at least 80.

15. The zoom lens according to claim 1,

wherein the Abbe number of all lenses having negative refractive power that are arranged on the side having the shorter conjugate distance with respect to an aperture stop is at least 35.

16. The zoom lens according to claim 1,

wherein the first lens group that has positive refractive power, the second lens group that has a negative refractive index and the third lens group that has a positive refractive index, arranged in that order from the side having the longer conjugate distance;

wherein when changing magnification from the wide angle end to the telephoto end, the first lens group, the second lens group and the third lens group move along the optical axis;

wherein the first lens group moves monotonically toward the side having the longer conjugate distance, the second lens group moves monotonically toward the side having the shorter conjugate distance and the third lens group moves monotonically toward the side having the longer conjugate distance and an aperture stop moves in conjunction with the third lens group; and

wherein the following relationship is satisfied:

$|(DG1 - DG3) / fw| < 0.15$

where DG1 is the amount that the first lens group moves from the wide angle end to the telephoto end, where DG3 is the amount that the third lens group moves from the wide angle end to the telephoto end and where fw is the focal length of the zoom lens at the wide angle end.

17. The zoom lens according to claim 1,

wherein the first lens group that has positive refractive power, the second lens group that has a negative refractive index and the third lens group that has a positive refractive index, arranged in that order

from the side having the longer conjugate distance;

wherein when changing magnification from the wide angle end to the telephoto end, the first lens group is fixed, and the second lens group and the third lens group move along the optical axis;

wherein the second lens group moves monotonically toward the side having the shorter conjugate distance and the third lens group moves monotonically toward the side having the longer conjugate distance and an aperture stop moves in conjunction with the third lens group; and

wherein the following relationship is satisfied:

$|DG3 / fw| < 0.15$

where DG3 is the amount that the third lens group moves from the wide angle end to the telephoto end and where fw is the focal length of the zoom lens at the wide angle end.

18. The zoom lens according to claim 1,
wherein the zoom lens is a projecting lens for a projector.

19. The zoom lens according to claim 1,
wherein the magnification ratio of the entire lens system is used in a range of -0.00058 times to -0.0188 times.

20. The zoom lens according to claim 1,
wherein the F number is 2.5 or 2.4.

21. The zoom lens according to claim 1,
wherein the zoom ratio is 1.5, 1.6 or 1.65.

22. The zoom lens according to claim 1,
wherein the zoom lens does not have a joined surface.

23. A video enlarging/projecting system comprising:

a projecting lens in which the zoom lens according to claim 1 is used;

a light source, and

a spatial optical modulating element that is illuminated by light irradiated from the light source, and that forms an optical image,

wherein the projecting lens projects the optical image that is formed on the spatial optical modulating element.

24. A video projector comprising:

a projecting lens in which the zoom lens according to claim 1 is used;

a light source;

means for temporally restricting light from the light source to three colors of blue, green and red, and

a spatial optical modulating element that is illuminated by light irradiated from the light source, and that forms an optical image that corresponds to three colors of blue, green and red that temporally change.

25. A rear projector comprising:

a video projector according to claim 24,

a mirror that bends light that is projected from a projecting lens, and

a transmissive-type screen for reflecting an image of projected light.

26. A multivision system comprising:

a plurality of systems comprising:

a video projector according to claim 24,

a transmissive-type screen for reflecting an image of projected light, and

a casing; and further comprising

an image separating circuit for separating images.